

CLAIMS

What is claimed is:

1. A transmitter circuit comprising:
 - a phase shifter operatively responsive to phase shift compensation and timing data to phase shift input data by a compensation phase shift amount to produce a phase shifted signal; and
 - an amplifier coupled to an output of the phase shifter to receive the phase shifted signal, wherein the amplifier causes a predicted phase change to the received phase shifted signal in response to a control signal,
 - wherein the phase shifter receives the phase shift compensation and timing data and the amplifier receives the control signal at a predefined relative time such that the compensation phase shift in the phase shifted signal compensates for the predicted phase change in the amplifier to produce an RF output signal with reduced phase discontinuity.
 2. The transmitter circuit of claim 1 further including a phase compensation and timing control circuit operatively coupled to the amplifier to provide the control signal, and operatively coupled to the phase shifter to provide the phase shift compensation and timing data at the predefined relative time such that the compensation phase shift in the phase shifted signal compensates for the predicted phase change to produce the RF output signal with the reduced phase discontinuity.
 3. The transmitter circuit of claim 1, wherein the phase shifted signal reduces at least one of a transient phase change of the RF output signal, and a steady state phase change of the RF output signal.

4. The transmitter circuit of claim 1 wherein the compensation phase shift produced in the phase shifted signal in response to the phase shift compensation and timing data has a waveform shape associated with an inverse of the predicted phase change.

5. The transmitter circuit of claim 1, wherein the compensation phase shift in the phase shifted signal includes at least one of a step phase shift compensation signal, a ramp phase shift compensation signal, an exponential phase shift compensation signal, an inverse of the predicted phase change compensation signal, and a programmable phase shift compensation signal.

6. The transmitter circuit of claim 1, wherein the predefined relative time corresponds to at least one of: a fixed time period, an exponential time period, a period of time before a data burst, a period of time after a data burst, and a programmable amount of time.

7. The transmitter circuit of claim 1, wherein the control signal includes at least one of a waveform shape associated with the predicted phase change, a ramp phase shift waveform, waveform shape associated with an inverse of the predicted phase change, an exponential phase shift waveform and a programmable phase shift compensation signal waveform.

8. The transmitter circuit of claim 1, wherein the phase shifter is operatively responsive to phase shift compensation and timing removal data to remove the phase shift from the input data, wherein the phase shifter receives the phase shift compensation and timing removal data and the amplifier receives a remove control signal at a predefined relative removal time.

9. The transmitter circuit of claim 2 wherein the phase compensation and timing control circuit includes:

processing circuitry;
a storage unit coupled to the processing circuitry for storing one or more sets of instructions for execution by the processing circuitry including:
presorted instructions to receive the system based circuit activation data; and
presorted instructions operatively responsive to the system based activation data to generate the phase shift compensation and timing signal and the control signal.

10. A transmitter circuit comprising:
 - a phase compensation and timing control circuit operatively responsive to system based circuit activation data to produce phase shift compensation and timing data and a control signal;
 - a pulse shaper operatively responsive to input data to provide shaped input data, wherein the shaped input data corresponds to oversampled shaped input data,
 - a phase shifter operatively responsive to the phase shift compensation and timing data to select at least one of the oversampled shaped input data as selected shaped data and to phase shift the selected shaped input data by a compensation phase shift to produce a phase shifted signal at an output of the phase shifter; and
 - an amplifier coupled to the output of the phase shifter to receive the phase shifted signal, wherein the amplifier causes a predicted phase change to the received phase shifted signal in response to the control signal,
 - wherein the phase shifter receives the phase shift compensation and timing data and the amplifier receives the control signal at a predefined relative time such that the compensation phase shift in the phase shifted signal compensates for the predicted phase change in the amplifier to produce an RF output signal with a reduced phase discontinuity.
11. The transmitter circuit of claim 10 further including:

a delay circuit operatively coupled to the pulse shaper and operatively responsive to the shaped input data to produce a delayed shaped input signal;

a modulation calculation circuit operatively coupled to the pulse shaper and operatively responsive to the shaped input data to produce shaped input magnitude data,

wherein the phase compensation and timing control circuit includes;

a processing circuit responsive to system based circuit activation data to provide phase data to the phase shifter and to provide programmable threshold level data;

a timing control circuit operatively responsive to the phase data to provide the control signal to the amplifier; and

a threshold circuit to provide a timing signal to the phase shifter in response to comparing the shaped input magnitude data with the programmable threshold level data,

wherein the phase shifter produces the phase shifted signal in response to the delayed shaped input signal, the phase data, and the timing signal.

12. The transmitter circuit of claim 10:

wherein the phase compensation and timing control circuit includes:

a processing circuit operatively responsive to the system based circuit activation data to provide phase data to the phase shifter; and

a timing control circuit operatively responsive to the phase data and responsive to provide the control signal to the amplifier, and to provide a timing signal to the phase shifter,

wherein the pulse shaper is operatively responsive to in-phase data and quadrature data to provide shaped in-phase data and shaped quadrature data to the phase shifter,

wherein the phase shifter is operative to produce phase shifted in-phase data and phase shifted quadrature data in response to the timing signal, the phase data, the shaped in-phase data, and the shaped quadrature data.

13. The transmitter circuit of claim 12 further including:
 - an in-phase digital to analog converter operatively responsive to the phase shifted in-phase data to produce a phase shifted in-phase signal;
 - a quadrature digital to analog converter operatively responsive to the phase shifted quadrature data to produce a phase shifted quadrature signal; and
 - a modulator operatively responsive to the phase shifted in-phase signal and the phase shifted quadrature signal to provide an RF modulated signal to the amplifier.
14. The transmitter circuit of claim 10, wherein the phase shifted signal reduces at least one of a transient predicted phase change of the RF output signal, and a steady state predicted phase change of the RF output signal.
15. A transmitter circuit comprising:
 - a phase compensation and timing control circuit operatively responsive to system based circuit activation data to produce phase shift compensation and timing data and a control signal;
 - a phase shifter operatively responsive to the phase shift compensation and timing data to phase shift input data by a compensation phase shift to produce a phase shifted signal;
 - a pulse shaper operatively coupled to an output of the phase shifter to receive the phase shifted signal, and to responsively provide shaped and shifted input data; and
 - an amplifier operatively coupled to an output of the pulse shaper to produce the RF output signal in response to the shaped and shifted input data and the control signal,

wherein the amplifier causes a predicted phase change to the shaped and shifted input data in response to the control signal;

wherein the phase shifter receives the phase shift compensation and timing data and the amplifier receives the control signal at a predefined relative time such that the compensation phase shift in the shaped and shifted input data compensates for the predicted phase change in the amplifier to produce an RF output signal with a reduced phase discontinuity.

16. The transmitter circuit of claim 15 wherein:

wherein the phase compensation and timing control circuit includes:
a processing circuit to provide phase data to the phase shifter; and
a timing control circuit operative to provide a timing signal to the phase shifter and to provide the control signal to the amplifier,

wherein the phase shifter is operative to produce phase shifted in-phase data and phase shifted quadrature data in response to the phase data, the timing signal, in-phase data and quadrature data,

wherein the pulse shaper is operatively responsive to the phase shifted in-phase data and the phase shifted quadrature data to provide shaped in-phase data and shaped quadrature data.

17. The transmitter circuit of claim 16 including:
an in-phase digital to analog converter operatively responsive to the shaped in-phase data to produce an in-phase signal;
a quadrature digital to analog converter operatively responsive to the shaped quadrature data to produce a quadrature signal; and

a modulator operatively responsive to the in-phase signal and the quadrature signal to provide an RF modulated signal to the amplifier.

18. The transmitter circuit of claim 15 wherein the phase compensation and timing control circuit includes:

processing circuitry;

a storage unit coupled to the processing circuitry for storing one or more sets of instructions for execution by the processing circuitry including:

presorted instructions to receive the system based circuit activation data; and

presorted instructions operatively responsive to the system based activation data to generate the phase shift compensation and timing signal and the control signal.

19. The transmitter circuit of claim 15 wherein the phase shifted signal includes a plurality of constellation points wherein at least one of the plurality of constellation points is replaced with a zero constellation value.

20. A wireless device comprising:

a phase shifter operatively responsive to phase shift compensation and timing data to phase shift input data by a compensation phase shift to produce a phase shifted signal;

an amplifier coupled to an output of the phase shifter to receive the phase shifted signal, wherein the amplifier causes a predicted phase change to the received phase shifted signal in response to a control signal,

wherein the phase shifter receives the phase shift compensation and timing data, and the amplifier receives the control signal at a predefined relative time such that the compensation phase shift in the phase shifted signal compensates for the predicted phase change in the amplifier to produce an RF output signal with a reduced phase discontinuity;

a base band processor to produce the input data; and

an antenna operatively responsive to the RF output signal to transmit the RF output signal.

21. The wireless device of claim 20 further including a phase compensation and timing control circuit operatively coupled to the amplifier to provide the control signal and operatively coupled to the phase shifter to provide the phase shift compensation and timing data at the predefined relative time such that the compensation phase shift in the phase shifted signal compensates for the predicted phase change to produce the RF output signal with the reduced predicted phase change.

22. An amplification method comprising:

producing phase shift compensation and timing data and a control signal at a predefined relative time in response to system based circuit activation data;

phase shifting input data by a compensation phase change in response to the phase shift compensation and timing data to produce a phase shifted signal; and

providing the control signal at the predefined relative time with respect to producing the phase shift compensation and timing data to an amplifier to produce an RF output signal;

wherein the compensation phase change in the phase shifted signal reduces phase discontinuity in the RF output signal of the amplifier.

23. The method of claim 22 including:

producing shaped input data in response to the input data, wherein the shaped input data corresponds to oversampled input data;

selecting at least one of the oversampled input data corresponding to each shaped input data as selected data;

phase shifting the selected data by a phase shift associated with the predicted phase change to produce the phase shifted signal to the amplifier.

24. The method of claim 23 including:
 - delaying the shaped input data to produce a delayed shaped input signal;
 - receiving the shaped input data to produce shaped input magnitude data;
 - comparing the shaped input magnitude data with programmable threshold level data;
 - wherein the phase shift compensation and timing data includes phase data;
 - providing a timing signal in response to comparing the shaped input magnitude data with the programmable threshold level data; and
 - producing the phase shifted signal in response to the delayed shaped input signal, the phase data, and the timing signal.
25. The method of claim 22 including:
 - producing shaped and shifted input data in response to the phase shifted signal; and
 - producing the RF output signal by the amplifier in response to the shaped and shifted input signal.